# The Net Energy Value Of Ethanol: Critical Issues.

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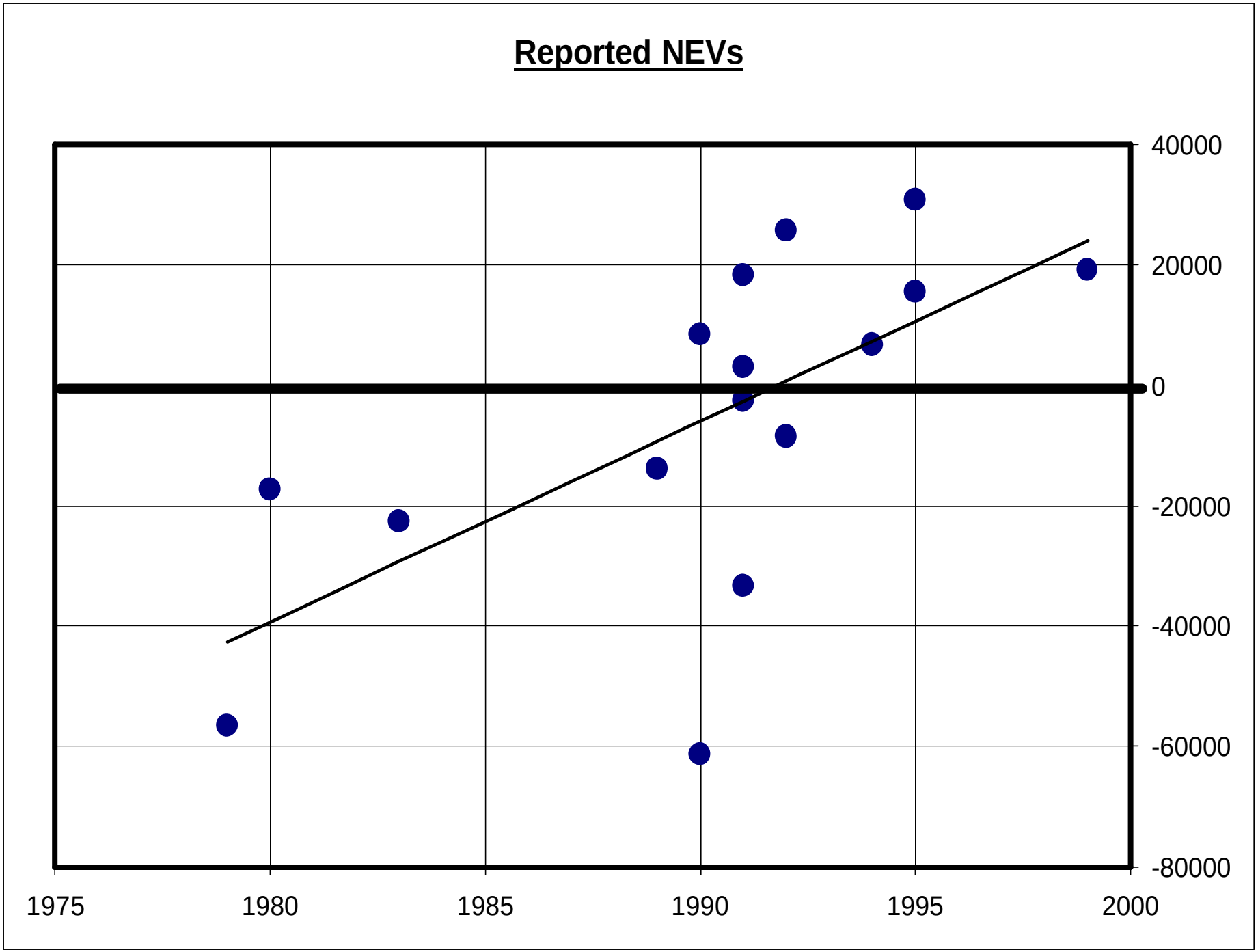
# Critical Issues To Consider…

- Biases
- Data Origins
- Boundaries
- Heating Values (LHV vs. HHV)
- Co-Product Allocation Methods


Reported NEVs
40000
20000
0
-20000
-40000
-60000
-80000
1975
1980
1985
1990
1995
2000

**FARMING**

**ELECTRICITY**

**LIQUID FUELS:**

- DIESEL
- GASOLINE

- $K_2O$
- $P_2O_5$
- $N_2O$
- PESTICIDE

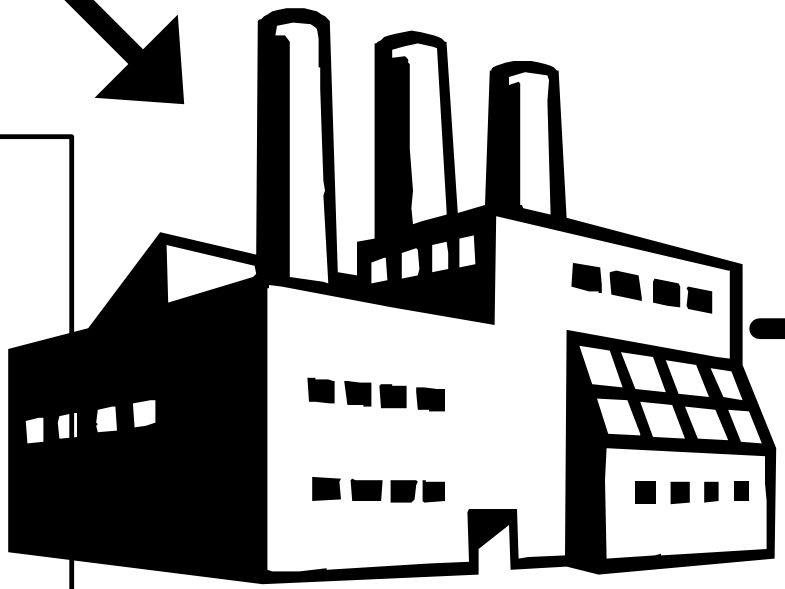
**CONSUMER**

**THERMAL (STEAM):**

- COAL
- OIL
- NATURAL GAS
- WASTE
- RECYCLED

**ELECTRICITY:**

- BOUGHT
- PRODUCED



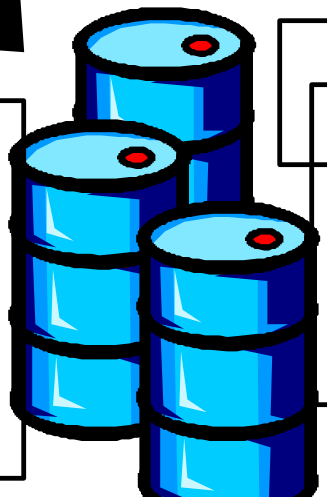
**PROCESSING**

**ETOH**

- LOW HEATING VALUE
- HIGH HEATING VALUE

**METHOD OF ALLOCATION:**

- MARKET VALUE
- TRUE VALUE
- OUTPUT WEIGHT BASIS
- REPLACEMENT VALUE



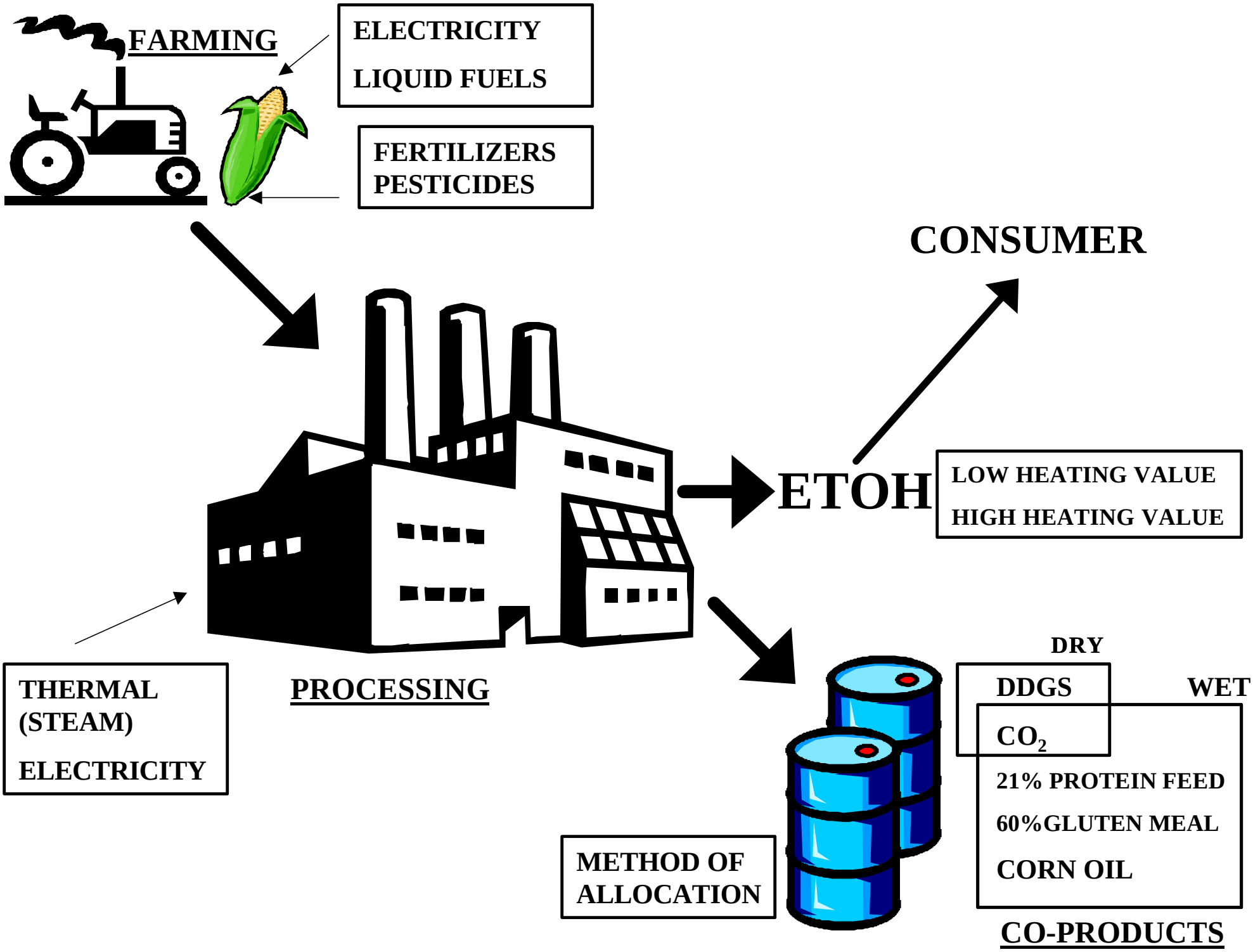
**DRY**

**DDGS**

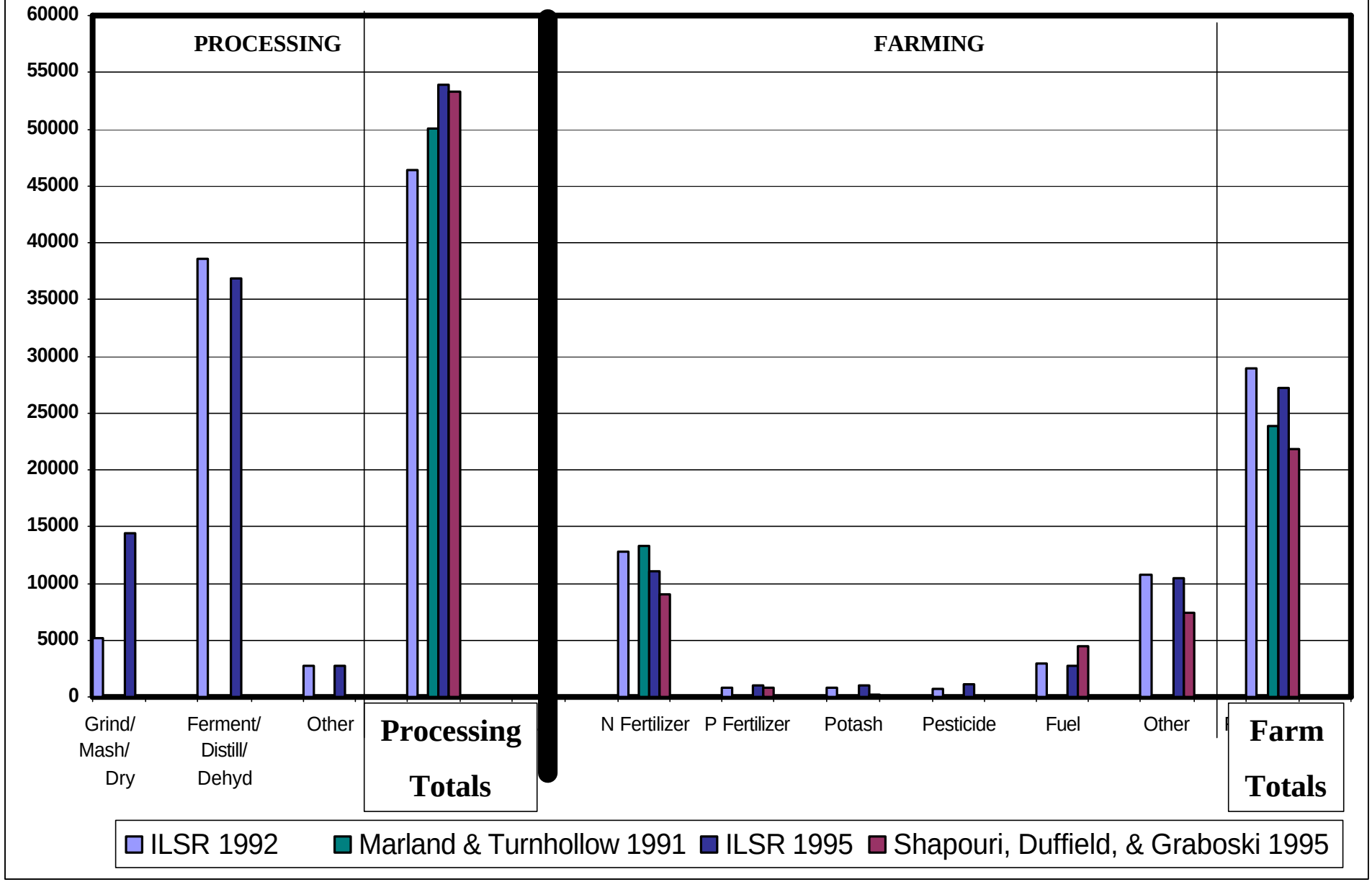
**WET**

- $CO_2$
- 21% PROTEIN FEED
- 60%GLUTEN MEAL
- CORN OIL

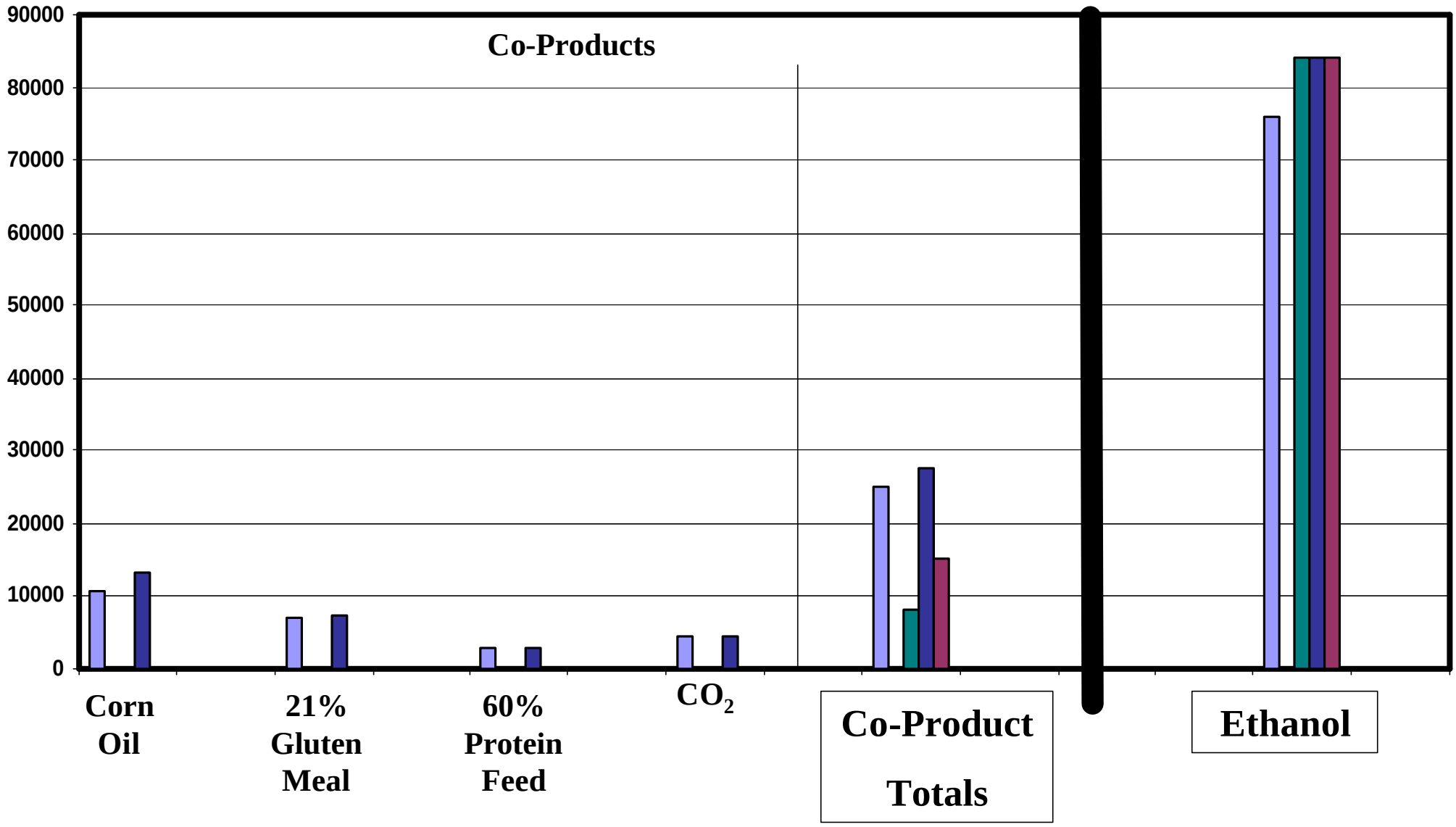
**CO-PRODUCTS**

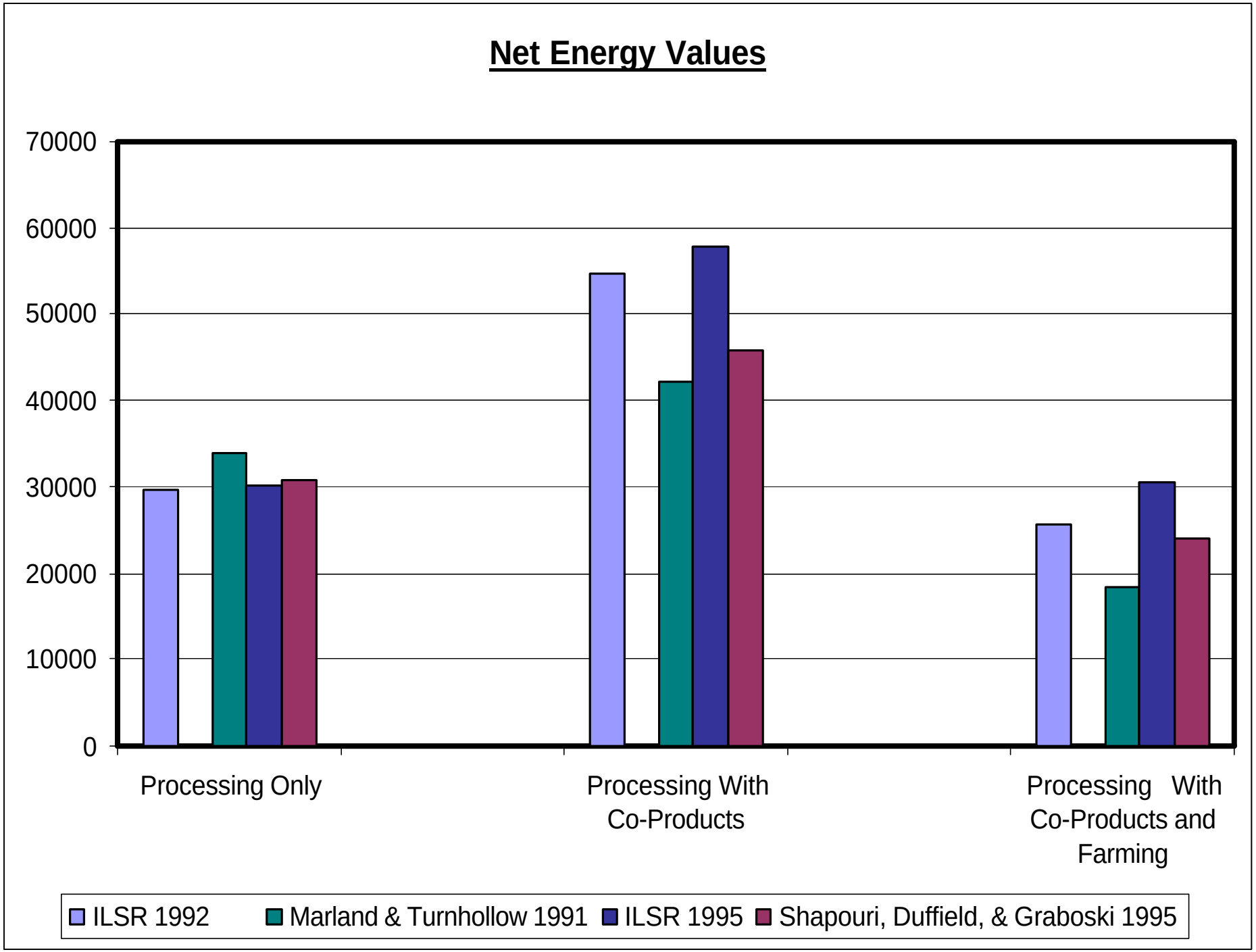

FARMING
ELECTRICITY
LIQUID FUELS
FERTILIZERS
PESTICIDES
CONSUMER
ETOH
LOW HEATING VALUE
HIGH HEATING VALUE
THERMAL (STEAM)
ELECTRICITY
PROCESSING
DRY
DDGS
WET
$CO_2$
21% PROTEIN FEED
60%GLUTEN MEAL
CORN OIL
METHOD OF ALLOCATION
CO-PRODUCTS

# Energy Used


60000
55000
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
PROCESSING
FARMING
Grind/ Mash/ Dry
Ferment/ Distill/ Dehyd
Other
Processing Totals
N Fertilizer
P Fertilizer
Potash
Pesticide
Fuel
Other
Farm Totals
ILSR 1992
Marland & Turnhollow 1991
ILSR 1995
Shapouri, Duffield, & Graboski 1995

# Energy Gained




Net Energy Values
70000
60000
50000
40000
30000
20000
10000
0
Processing Only
Processing With Co-Products
Processing With Co-Products and Farming
ILSR 1992
Marland & Turnhollow 1991
ILSR 1995
Shapouri, Duffield, & Graboski 1995

# Focal Points For Additional Research:

- Improve technology for fermentation and distillation processes.
- Reduce need for nitrogen-based fertilizers.
- Explore impacts of bioengineered corn on farming methods/inputs and yields.
- Clarify co-product credit allocation methods and feasibility of markets.

# Energy Issues Beyond The Balance (Additional Credit?)

- Accessible vs. Inaccessible
- Domestic vs. Foreign
- Renewable(?) vs. Non-Renewable
- Alternative Feedstocks

# References


Congress of The United States, Office of Technical Assessment, *Gasohol – A Technical Memorandum*, September, 1979.

Ho, S.P., *Global Warming Impact of Ethanol Versus Gasoline*, Washington, DC, October, 1989.

International Energy Agency and the Organization for Economic Co-operation and Development, Biofuels, France, 1994.

Keeney, D.R., and T.H.DeLuca, *Biomass as an Energy Source for the Midwestern U.S.*, American Journal of Alternative Agriculture, Vol. 7 (1992), pp.137-143.

Lorenze, David, David Morris, *How Much Energy Does it Take to Make a Gallon of Ethanol*?, Institute for Local Self-Reliance, August, 1995.

Marland, G., and A.F. Turnhollow, *CO2 Emissions From the Production and Combustion of Fuel Ethanol From Corn*, U.S. Department of Energy, February, 1991.

Morris, David, Irshad Ahmed, *How Much Energy Does it Take to Make a Gallon of Ethanol*?, Institute for Local Self-Reliance, December, 1992.

Pimental, David, *Ethanol Fuels: Energy Security, Economics, and the Environment*, Journal of Agricultural and Environmental Ethics, Vol. 4 (1991), pp.1-13.

Shapouri, Hosein, James A. Duffield, Michael S. Graboski, *Estimating the Net Energy Balance of Corn Ethanol*, U.S. Department of Agriculture, Economic Research Service, Office of Energy, Agricultural Economic Report No. 721, July, 1995.

U.S. National Alcohol Fuels Commission, *Ethanol: Farm and Fuel Issues*, August, 1980.

U.S. National Alcohol Fuels Commission, *Energy Balances in the Production and End-Use of Alcohols Derived From Biomass, A Fuels-Specific Comparative Analysis of Alternate Ethanol Production Cycles*, U.S. Department of Energy, October, 1980..

Wayman, Morris, Sarad R. Parekh, Biotechnology Of Biomass Conversion, Fuel and Chemicals From Renewable Resources, Prentice Hall, New Jersey, 1990.